Appendix N
Multipurpose Reactor

A multipurpose reactor is a reactor that can produce tritium, use plutonium (Pu)-based fuel, and/or offset operating costs through revenues generated from the sale of electricity. In the past, Congress and commercial parties, including reactor vendors, have expressed interest in developing a multipurpose reactor that could both meet the nations tritium supply requirements and accommodate the disposition of surplus Pu. In the National Defense Authorization Act for Fiscal Year 1996, Congress directed that the Department of Energy (DOE) include a cost-benefit analysis in the *Storage and Disposition of Weapons-Usable Fissile Materials Programmatic Environmental Impact Statement* (Storage and Disposition PEIS) of the multipurpose reactor using the Advanced Light Water Reactor (ALWR) and Modular Helium Reactor (MHR) technologies. DOE has also received comments on the Storage and Disposition PEIS concerning certain types of multipurpose reactors including the Fast Flux Test Facility (FFTF) at Hanford Site (Hanford), which would actually be a dual purpose reactor than a multipurpose reactor as characterized above.

The purpose of this appendix is to provide information on the costs and benefits of carrying out two separate projects for the performance of the tritium production and Pu disposition missions, versus the costs and benefits of carrying out one multipurpose project for both missions. Information in the appendix is not a proposal for action by the Department, nor is it an analysis of the multi-purpose reactor technology that would allow it to be selected in the Storage and Disposition PEIS Record of Decision (ROD). This information is presented in the interest of more fully informing the decision-maker and the public regarding discussions about the potential utility of multi-purpose reactors for overlapping or simultaneous Departmental missions. The cost-effectiveness of using FFTF is not known, beyond the common-sense proposition that using an existing facility could be an advantage. Furthermore, neither the multipurpose reactor nor the FFTF in a dual-purpose mode has been proposed or subjected an independent system analysis by the Department.

N.1 BACKGROUND

An evaluation of multipurpose reactors was performed as part of DOE's *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (TSR PEIS) (DOE/EIS-0161, October 1995). This evaluation was a part of the TSR PEIS because the multipurpose reactor could potentially offer the capability of producing tritium at a reduced cost compared to other tritium production options through the sharing of costs with the Pu disposition mission. The TSR PEIS evaluated the potential environmental impacts for multipurpose reactors for ALWR, Modular High Temperature Gas-Cooled Reactor (MHTGR), and existing commercial light water reactor (LWR) designs. Although the TSR PEIS also mentioned a MHR, an emerging design variation of the MHTGR, no detailed analyses of the MHR as a reasonable option for the tritium production mission were included.

All of these reactor types normally utilize uranium as fuel. Uranium fuel could continue to be used if one of these technologies were selected for tritium production; however, an all Pu fuel or a mixed oxide (MOX) fuel of Pu and uranium could also be used for a tritium production reactor. Both the LWR and gas cooled reactor technologies have been used for electrical power production but not for tritium production. While the technology exists in other countries for operating LWRs with MOX fuel, the gas cooled reactor has no MOX fuel operating experience.

The Department's TSR Record of Decision (ROD) was to pursue a dual track for tritium supply based on the two most promising tritium supply alternatives. This dual track consists of (1) initiating the purchase of an existing commercial reactor (operating or partially complete) or irradiation services with an option to purchase the reactor for conversion to a defense facility and (2) designing, building, and testing critical components of an accelerator system for tritium production. Within a 3-year period, DOE expects to select one of the tracks to serve as the primary source of tritium. The TSR ROD concluded that the use of LWRs, especially existing commercial reactors, has the highest potential for delivering new tritium gas by the required start date of 2011. The MHTGR and MHR were judged to have a lower probability of meeting this date because they have the potential for major technical or regulatory delays. They were also judged to have a lower probability than the other alternatives considered of being able to operate with sufficient reliability, to meet the annual tritium production requirements. Furthermore, total life cycle costs and operation and maintenance costs for gas reactors were high, especially for the MHTGR.

The TSR PEIS also considered tritium production in the FFTF, an existing liquid metal cooled reactor located at Hanford near Richland, Washington. It was dismissed in the TSR ROD as a long-term tritium supply option because its remaining life is substantially less than the long-term mission requirements for tritium production. The FFTF is also limited in the amount of tritium that it could produce, which is only a percentage of the tritium requirement. It was therefore not considered reasonable to rely on operating the facility as a long-term tritium supply option. Nevertheless, the TSR ROD indicated that DOE would conduct further evaluations to determine whether the operation of the FFTF might be able to play any role in meeting future tritium requirements. Although the FFTF produces no electricity and like the light water and gas cooled reactors has never been used for tritium production, it has been used in experimental capacities. Therefore, its utility as a multipurpose reactor is included in the discussion below.

The sizes of the multipurpose reactors considered for tritium production use based upon meeting specific tritium supply requirements and not on the disposition of a prescribed quantity of Pu within a reasonable (25-year) time period. These reactors would have to be capable of producing tritium at a steady state production mode and at an increased production mode should the need arise.

Plutonium disposition using a single multipurpose reactor would take longer than the disposition goal of 25 years from project authorization. This disposition goal could only be achieved by using more reactors (or an additional disposition option such as immobilization). This would be required for tritium production alone. Furthermore, if new reactor(s) were provided, the Pu disposition mission would be completed before the end of their useful design life for the reactors, thereby resulting in unneeded plutonium disposition capacity after approximately 15 years of operation (assuming 50 metric tons [t] (55 short tons) [tons] of Pu). Thus, while plutonium disposition would be possible in a multipurpose reactor, the primary purpose of the reactor would be tritium production.

N.2 NEW MULTIPURPOSE REACTORS

A new ALWR or MHR multipurpose reactor could potentially offer savings to the Government by combining the tritium production and Pu disposition missions into a single reactor program. Although it may be technically feasible for a multipurpose reactor to perform these combined missions, additional development, demonstration, and testing would be required to address a number of technical issues. These technical issues relate primarily to fuel and tritium target development and demonstration, and to related reactor modification and licensing requirements. These issues would be expected to have greater impact on the MHR than on an ALWR because of its extensive developmental requirements and lack of operating experience. Also issues related to the different capacity requirements (number of reactors) for each mission, and different refueling and re-targeting schedules would need to be addressed. The use of a single reactor for tritium production is not compatible with the Pu disposition objective of satisfying the Spent Fuel Standard in 25 years or less from the time of project authorization. Furthermore, a lower reliability would be expected for combined missions versus separate missions in separate reactors, because the problems and delays with one mission could impact the timely implementation of the other. For example, problems with MOX fuel performance (a disposition mission factor) or tritium target performance such as repeated leaks (a tritium production mission factor) could delay both missions. Whether this potentially lower reliability would impact the effective implementation of both these critically important missions is still an open question.

The Nuclear Regulatory Commission (NRC) evaluated MOX-burning LWRs in an environmental impact statement issued in 1976.[1] They included extensive information on the changes and impacts required for an LWR in order to allow it to utilize MOX fuel. This document was reviewed as part of DOE's analysis of the multipurpose ALWR.

N.3 ADVANCED LIGHT WATER REACTOR

The TSR PEIS considered four ALWR options: a large 1300-megawatt electric (MWe) pressurized water reactor (PWR) plant, a large 1,100-MWe boiling water reactor (BWR) plant, a small 600-MWe PWR plant, and a small 600-MWe BWR plant. All ALWR options would use light (regular) water as the reactor coolant and moderator, and a steam cycle to remove heat from the light water coolant to generate electricity.

The ALWR concepts considered for tritium production are based on advanced commercial reactor designs developed by U.S. reactor vendors in conjunction with DOE. These commercial designs have been reviewed or are undergoing review by the NRC with the goal of simplifying their licensing process. They incorporate passive safety features and other advancements that would be expected in any new LWRs that might be built in the United States in the future. Advanced BWRs, similar to some of the designs being developed in the United States, are being built in Japan.

Although no ALWRs have been built in the United States, they are considered to have the lowest risk of any new reactor option evaluated for tritium production or Pu disposition because they are based on the light water technology and extensive operating experience of the 110 commercial reactors operating in this country today. A single multipurpose large ALWR (1,256 MWe) with a typical commercial reactor fuel cycle (18 to 24 months) could meet both the steady state and increased tritium production requirements. The steady state requirement could be achieved without having to displace any of the reactor's fuel rods with tritium target rods. However, the disposition of 50 t (55 tons) of surplus Pu in a single multipurpose reactor would take approximately 44 years from project authorization (12 years of plant design and construction and 32 years of operation). For the increased tritium production requirement, Pu disposition would take even longer since some of the reactor's fuel may have to be displaced by tritium targets to accommodate the higher tritium requirement. In order to produce the required amount of tritium and disposition 50 t (55 tons) of Pu in approximately 25 years from project authorization, two multipurpose ALWRs would be required. If a hybrid approach were chosen for Pu disposition in which reactors and immobilization were used, less than the full 50 t (55 tons) of Pu would be identified for disposition in reactors, and the disposition times and number of reactors would therefore be reduced.

N.4 MODULAR HELIUM REACTOR AND MODULAR HIGH TEMPERATURE GAS-COOLED REACTOR

The TSR PEIS considered the use of three 350-megawatt thermal (MWt) MHTGR modules for the production of tritium. The MHTGR concept uses a steam cycle to remove heat from the helium reactor coolant and to generate electricity. There has been some limited experience (with mixed success) in the United States and abroad with gas reactors using a steam cycle. However, the use of MOX fuel in MHTGR reactors designed to produce tritium would significantly reduce tritium production capability. Combining tritium production and Pu disposition in multipurpose gas reactors would require an increase to six 350-MWt MHTGR reactor modules in order to meet the increased tritium production requirement. However, this number of modules would still be insufficient to meet the 25 year Pu disposition objective. Approximately twenty-four 350-MWt reactor modules would be required to satisfy the Pu mission goal using the MHTGR technology. This number of reactors would be economically unattractive.

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[1] *Final Environmental Statement on the Use of Recycled Plutonium Mixed Oxide Fuel in Light Water Cooled Reactors* (GESMO) (NUREG-0002), August 1976.

The MHR concept is economically more attractive than the MHTGR because it has the potential to achieve higher thermal efficiencies and its advanced design allows reactors to be packaged into larger modules (600-MWt) than the 350-MWt MHTGR. Fewer MHR modules would therefore be required to satisfy the same tritium or Pu mission, and the cost of reactor construction and operations would be less. Two MHR reactor modules would be required to meet the increased tritium production requirement alone, without Pu disposition. Eight multipurpose reactor modules using a 2-year reactor fuel cycle proposed by the MHR vendor, would be required to satisfy the increased tritium production requirement and disposition approximately 50 t (55 tons) of surplus Pu. With eight 600-MWt MHR reactor modules, the disposition of 50 t (55 tons) of surplus Pu would take approximately 26 years from project authorization (12 years of plant construction and 14 years of operation).

The MHR can achieve substantial cost savings when compared to the MHTGR because it uses the reactor's helium coolant in a high efficiency direct-cycle gas turbine to generate electricity rather than in a steam cycle like the MHTGR. While the direct cycle approach has cost advantages and higher plant efficiency, it also has a much larger risk associated with bringing it to a level of technical maturity that would allow the Government to proceed with confidence in the timeframe required to meet tritium production and Pu disposition objectives.

Since the direct-cycle turbine power conversion system is new and unproven, it must complete an extensive design, development, testing, and demonstration program. Further, the integration of the power conversion system with the reactor system has not been demonstrated, and will require extensive design and development. In addition to the direct cycle turbine, only very limited experience exists with Pu fuel for gas reactors. Both the fabrication process and operational performance of the fuel must be developed and demonstrated. The Pu fuel fabrication facility for the MHR would be a first-of-a-kind facility and therefore represents one of the highest risk items for maintaining the aggressive schedule that would be required for tritium production and Pu disposition. Direct cycle turbine and fuel development activities required for the MHR would therefore represent a major risk to meeting mission objectives in a timely, reliable, and cost-effective manner. It was for this reason that DOE did not consider the MHR to be a reasonable alternative for either tritium production or Pu disposition, or both missions combined in a multipurpose MHR reactor.

N.5 COST COMPARISONS

N.5.1 ADVANCED LIGHT WATER REACTOR COSTS

For purposes of cost analysis, reactors were assumed to be located at the Savannah River Site (SRS). Costs were calculated for separate tritium production and Pu disposition missions in separate reactors, as well as for combined missions in a multipurpose reactor.

The cost/benefit of the multipurpose ALWR reactor option was analyzed for two cases: Government ownership and private ownership. In the case of Government ownership, the front-end costs which include the reactor, tritium recovery facility, pit disassembly/conversion facility, MOX fuel fabrication facility, and all associated research and development, would all be paid for by the Government. In the case of private ownership, the reactor and MOX fuel fabrication plant would be financed, constructed, and operated by a private entity. All other front-end costs would be paid for by the Government. Cost comparisons, expressed in discounted 1996 dollars, are provided in Table N.5.1–1. Costs shown are for construction and operation of the reactor and common facilities (pit disassembly/conversion, MOX fuel fabrication, tritium target fabrication). An average revenue return of $.029 per kilowatt-hour is assumed for electricity production over the life of the reactor. This return reflects the potential effect of deregulation of the electric power industry. This value was also used in the *Reactor Alternative Summary Report Vol. 4—Evolutionary LWR Alternative* (ORNL/TM-13275/r4) and the *Technical Summary Report for Surplus Weapons—Usable Plutonium Disposition* (DOE/MD-0003).

The Government ownership cases highlight the potential cost advantages of a multipurpose reactor as compared to building new reactors for each mission separately. The front-end costs to the Government for deploying

Table N.5.1-1. Advanced Light Water Reactor Costs (1996 Dollars)

Mission	Reactor Size	Front-End Costs (Dollars in Billions)	Discounted Life Cycle Costs (Dollars in Billions)	Discounted Total Costs for Both Missions (Dollars in Billions)
Private[a]				
Pu disposition only	Two ALWRs 2,512 MWe	0.32	4.1	7.0[b]
Tritium production only	One ALWR 1,100 MWe	0.34	2.9	
Multipurpose	Two ALWRs 2,512 MWe	0.66	4.4	4.4
Government[c]				
Pu disposition only[d]	Two ALWRs 2,512 MWe	6.9	3.7	7.0[b]
Tritium production only	One ALWR 1,100 MWe	4.3	2.0	
Multipurpose	Two ALWRs 2,512 MWe	7.2	3.7	3.7

[a] Privately owned MOX fuel fabrication facilities and reactors. Government owned Pu processing and tritium facilities.
[b] Sum of Pu disposition and tritium production.
[c] All government owned facilities.
[d] Same case as Table 4.2 of October 1996 Technical Summary Report for Surplus Weapons Usable Plutonium Disposition (Rev 1).

separate reactors and associated facilities versus the costs for two multipurpose reactors and associated facilities are $11.2 billion and $7.2 billion, respectively. The front-end cost for the multipurpose reactor is therefore $4.0 billion less than that for separate new reactors. The discounted life-cycle costs are $2.6 billion less for the two multipurpose reactors compared to the three reactor separate projects case.

The private ownership option assumes a combination of industry-based financing for a substantial part of the undertaking, together with debt financing for the balance. However, the potential feasibility of private financing must be tempered with the recognition that for more than 15 years, the commercial nuclear power industry has not found it economically and politically feasible to build new nuclear power plants in the United States. It is unlikely that passive investors would be willing to "project finance" the construction phase of the project (that is, where the debt and equity investors take the project risk), for the following reasons: the size of the investment; the risks associated with completing the construction of such a facility; and the general anxiety within the investment community over nuclear projects. There is some possibility that passive investors might be willing to finance such a project once it is built and operating; after NRC approvals and associated risks are complete; and after technology issues, construction delays, cost overruns, permitting, and initial startup testing are behind the project. Government support of a privately owned reactor may overcome some of these concerns, as suggested by the interest expressed by some industry groups in both single purpose and multipurpose reactors for tritium production and Pu disposition.

The private ownership cases highlight the potential cost advantages of private ownership. The front-end costs to the Government are significantly reduced for the reactors in the Pu disposition only case ($6.6 billion reduction), the tritium production only case ($4.0 billion reduction), and the multipurpose reactor case ($6.6 billion reduction), when compared to Government ownership because the front-end costs of the reactor and MOX fuel fabrication facility would be financed by a private entity. For the multipurpose reactor, the discounted life-cycle cost is increased, however, by about $0.7 billion as a result of the higher financing costs for a private owner combined with tax effects and the desire by the private investor for a return on investment. These costs are ultimately paid for by the Government as part of the irradiation service over the 40-year operating life of the reactor. Potential advantages of private ownership would be lower front-end costs and the fact that Government outlays could be spread over the life of the project.

The Department tasked a consultant (Putnam, Hayes & Bartlett, Inc. [PHB]) to provide an independent cost analysis of DOE's tritium production alternatives, including a preliminary assessment of the multipurpose ALWR option. For the multipurpose reactor option, the PHB report[2] analyzed the costs of a Government-owned multipurpose reactor and a privately financed and owned option for three cases: the purchase of an existing commercial LWR; the construction and operation of a new small ALWR; and the construction and operation of a new large ALWR.

The PHB analysis of cost impacts of privately financing the multipurpose reactor indicates that only the purchase of an existing reactor would result in a cost benefit to the Government. The PHB report shows that privatization of such a multipurpose reactor could provide savings to the Government of about $1 billion in discounted life-cycle cost compared to the cost of separate reactors for tritium production and Pu disposition. A privately financed and owned multipurpose reactor could cost the Government an additional $0.7 billion to $11.4 billion in discounted cost compared to the Government ownership option as a result of the higher financing cost for a private owner and the desire by the private investor for a return on investment. This result depends heavily on electricity unit revenues and the terms that private participants are willing to offer DOE. The PHB report concluded that private financing may provide benefits to the Government, but should be examined by DOE after a tritium supply option or strategy is chosen.

N.5.2 Modular Helium Reactor Costs

For purposes of MHR cost analysis, reactors were again assumed to be located at Savannah River Site. As in the case of the ALWR, costs were calculated for separate tritium production and Pu disposition missions in separate reactors, as well as for combined missions in a multipurpose MHR. The cost/benefit of the multipurpose MHR option was analyzed for two cases: Government ownership and private ownership. In the case of Government ownership, the front-end costs, which include the reactor, tritium recovery facility, pit disassembly/conversion facility, MOX fuel fabrication facility, and all associated research and development, would all be paid for by the Government. In the case of private ownership, the reactor and MOX fuel fabrication facility would be financed, constructed, and operated by a private entity. All other front-end costs would be paid for by the Government. Cost comparisons, expressed in discounted 1996 dollars, are provided in Table N.5.2–1. Costs shown are for construction and operation of the reactor and common facilities (pit disassembly/conversion, MOX fuel fabrication, tritium target fabrication). An average revenue return of $.029 per kilowatt-hour is assumed for electricity production over the life of the reactor.

For the Government ownership option, the Government's front-end costs for the multipurpose MHR plant and the sum of the costs for separate reactor plants for tritium production and Pu disposition, were calculated to be about $6.5 billion and $8.1 billion, respectively. The potential cost advantage of the multipurpose MHR would be about $1.6 billion in front-end costs.

With regard to private financing, the MHR would not be feasible until after a period of successful operation of a demonstration facility. Financing for a multipurpose MHR would be difficult in view of the poor operating history of the Fort Saint Vrain facility, a gas-cooled reactor plant in Colorado that experienced a multitude of operational problems. The revolutionary nature of its design, the development and demonstration requirements associated with the reactor fuel and direct cycle turbine, and the lack of NRC review would be further impediments to private financing.

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[2] DOE Tritium Production Options: Putnam, Hayes & Bartlett Final Report On Cost Analysis, September 1, 1995 (Text Revision October 15, 1995).

Table N.5.2–1. Modular Helium Reactor Costs (1996 Dollars)

Mission	Reactor Size[a]	Front-End Costs (Dollars in Billions)	Discounted Life Cycle Costs (Dollars in Billions)	Discounted Total Costs for Both Missions (Dollars in Billions)
Private[b]				
Pu disposition only	8 modules 2,288 MWe	0.32	3.5	5.0[c]
Tritium production only	2 modules 572 MWe	0.68	1.5	
Multipurpose	8 modules 2,288 MWe	1.0	4.1	4.1
Government[d]				
Pu disposition only	8 modules 2,288 MWe	5.8	3.1	5.0[c]
Tritium production only	2 modules 572 MWe	2.3	1.0	
Multipurpose	8 modules 2,288 MWe	6.5	3.7	3.7

[a] Each reactor module is designed to produce 286 MWe.
[b] Privately owned MOX fuel fabrication facilities and reactors. Government owned Pu Processing and tritium facilities.
[c] Sum of Pu disposition and tritium production.
[d] All government facilities.

For the privately owned multipurpose MHR, the front-end costs could be reduced by about $5.5 billion relative to the Government-owned multipurpose reactor option because the reactors and the fuel fabrication plant would be financed, constructed, and operated by private entities. The privately owned multipurpose reactor would cost the Government about $0.4 billion more in discounted life cycle costs compared to the Government-owned option. This increase, as in the case of the ALWR, is the result of higher financing costs for a private owner combined with tax effects and the desire of the private investor for a return on investment. These costs would ultimately be paid for by the Government as part of the irradiation service over the operating life of the reactor. Again, potential advantages of private ownership would be lower front-end costs and the fact that the Government outlays could be spread over the life of the project.

N.6 FAST FLUX TEST FACILITY

As part of the process of selecting Pu disposition technologies for evaluation in the Storage and Disposition PEIS, DOE considered the FFTF, a liquid metal reactor at Hanford, because it was an existing facility that would not require the large commitment of time and money that a new reactor would require for implementation of the Pu disposition mission. The FFTF, however, was eliminated because it was in a standby status awaiting shutdown and because it could not satisfy the Storage and Disposition PEIS criterion of completing the disposition mission within 25 years using the historic FFTF Pu fuel enrichment specifications.

It has been suggested by commentors in this PEIS and others that the use of the FFTF as an integral part of the nation's tritium production infrastructure might help ensure the tritium supply by 2005 and at the same time provide a way to begin the disposition of surplus weapons-usable Pu as well as provide a source of medical isotopes.

As noted in the DOE's December 5, 1995 ROD on Tritium Supply and Recycling, DOE is evaluating the operation of the FFTF to determine if it might have a role in meeting future tritium requirements. If DOE proposes and subsequently decides to use the FFTF for tritium production, then, in order to accomplish this mission, a portion of the fuel-usable surplus Pu could be used to operate the FFTF.[3] Before the FFTF could begin to use this Pu for the production of tritium, 3 to 4 years would be required to develop and test a higher Pu enriched reactor fuel and to establish a MOX fuel fabrication capability. Under these conditions, it would take at least 35 years from a ROD to disposition the surplus weapons-grade Pu that is suitable for use in reactors, or a supplementary disposition approach (such as immobilization) would be needed for the unused balance.

At the time this Storage and Disposition PEIS went to print, DOE had not proposed to use FFTF for tritium production. If DOE proposes to consider the FFTF in detail for this purpose, appropriate *National Environmental Policy Act* review will be performed.

N.7 SUMMARY

A single multipurpose ALWR could perform the tritium mission at a steady state mode but it would not provide the capability to disposition surplus Pu in a timely manner. For a single new large multipurpose ALWR operating on a typical commercial fuel cycle, it would take approximately 12 years of design and construction and 32 years of operation (a total of 44 years) to disposition 50 t (55 tons) of Pu. The same reactor could meet an increased tritium production requirement, but Pu disposition would take longer since some of the reactor's fuel may have to be displaced by tritium targets to accommodate the higher production requirement. Two multipurpose ALWRs would be required to meet the increased tritium production requirement and complete Pu disposition within the goal of 25 years from project authorization.

Two MHR reactor modules would be required to meet the increased tritium production requirement alone, without Pu disposition. Eight MHR modules would be required to meet the same tritium production requirement and complete the Pu disposition mission in 26 years (12 years for construction and 14 years for operation).

The use of the FFTF, or new multipurpose reactors sized for tritium production alone, could provide cost advantages to the Government in front-end costs and overall life cycle costs relative to the use of separate new reactor facilities for tritium production and Pu disposition. However, these cost savings would need to be balanced against the impacts of the slower Pu disposition rate imposed by the limited reactor capacity of these options. The goal of completing the disposition mission within 25 years of project authorization could only be achieved if additional reactors were to be provided or other means of disposition employed, such as immobilization. In the case of multiple new reactors, the disposition mission would be completed before the end of the useful design life of the reactors, which would result in unneeded reactor capacity.

[3] The rate of utilization would be about one ton per year maximum. See Use of the Fast Flux Test Facility for Tritium Production (the "JASON Report"), S. Drell and D. Hoummer, Co-chairs, The MITRE Corporation, McLean, Virginia, September 11, 1996, page 22 (draft).